

Claims

1. A process of separating suspended solids from a fermentation liquor by subjecting the liquor to a solids-liquid separation stage, wherein the fermentation liquor is produced in a fermentation process for the production of a fermentation product, which liquor comprises water, lignin and BOD, wherein the solids-liquid separation stage is assisted by a treatment system, characterised in that the treatment system comprises either,
 - (i) a cationic polymer having an intrinsic viscosity (IV) of at least 4 dl/g at a dose of above 2 kg/tonne based on dry weight of suspension, or
 - (ii) a cationic polymer having an intrinsic viscosity (IV) of at least 4 dl/g and,
 - (iii) an anionic polymer , and/or
 - (iv) a cationic polymer of intrinsic viscosity of below 4 dl/g and a cationic charge density of at least 3 meq/g and/or
 - (v) inorganic coagulants and/or
 - (vi) charged microparticulate material.
2. A process according to claim 1 in which the fermentation liquor is subjected to a distillation stage wherein the fermentation product is recovered, wherein the liquor is removed from the distillation stage as a stillage stream and then subjected to the solids-liquid separation stage.
3. A process according to claim 1 in which the fermentation liquor contains the fermentation product wherein the liquor is subjected to the solids-liquid separation stage and then passed to a distillation stage wherein the fermentation product is recovered
4. A process according to any of claims 1 to 3 in which the treatment system comprises (i) a low IV cationic polymer of intrinsic viscosity of below 4 dl/g and a cationic charge density of at least 3 meq/g and (ii) a high IV cationic polymer of intrinsic viscosity of at least 4 dl/g.
5. A process according to any of claims 1 to 4 in which the low IV polymer is selected from the group consisting of polyamines, amine/epihalohydrin addition polymers, polymers of dicyandiamide with formaldehyde, polymers of diallyldimethyl ammonium chloride (DADMAC), cationic starch and cationic inulin.

6. A process according to any of claims 1 to 5 in which the inorganic coagulant is selected from alum and polyaluminium chloride (PAC).

7. A process according to claims 1 to 6 in which the coagulant is a charged microparticulate material,

8. A process according to any of claims 5 to 7 in which the high IV polymer is selected from water-soluble or water-swellable polymers, which polymer is a natural polymer, semi-natural polymer or a synthetic polymer which has been formed from ethylenically unsaturated water-soluble monomer or monomer blend.

9. A process according to any of claims 5 to 8 in which the high IV polymer is either a chitosan based material or a polymer of acrylamide with one or more water soluble cationic monomers selected from dialkylaminoalkyl (meth) acrylates, dialkylaminoalkyl (meth) acrylamides and acid addition salts or quaternary ammonium salts thereof.

10. A process according to any of claims 5 to 9 in which the coagulant and high IV polymer are added sequentially, preferably employing the coagulant first.

11. A process according to any of claims 5 to 10 in which the coagulant and high IV polymer are added simultaneously, preferably as a premix.

12. A process according to claim 11 in which the premix comprises (i) a low IV cationic polymer of intrinsic viscosity of below 4 dl/g and a cationic charge density of at least 3 meq/g and (ii) a high IV cationic polymer of intrinsic viscosity of at least 4 dl/g.

13. A process according to any of claims 1 to 12 in which the dose of coagulant is at least 50 grams per tonne (based on dry weight of fermentation liquor).

14. A process according to any of claims 5 to 13 in which the dose of high IV polymer is at least 50 grams per tonne (based on dry weight of fermentation liquor).

15. A process according to any of claims 1 to 14 in which the fermentation liquor is subjected to a mechanical dewatering stage during or subsequent to application of the treatment system.

16. A process according to claim 15 in which the mechanical dewatering step is selected from at least one of, a centrifuge, a screw press, a filter press, a belt filter press a horizontal belt filter or preferably a pressure filter.

17. A process according to any of claims 1 to 16 in which the treated liquor from which suspended solids have been removed are recycled and used as wash water.
18. A process according to any of claims 1 to 17 in which the fermentation liquor comprises lignin and in which the separated solids are dewatered and then subjected to a drying stage to provide a dry solid material and in which the dry solid material is used as a solid fuel.
19. A process according to any of claims 1 to 18 in which the fermentation product is selected from the group consisting of ethanol, glycerol, acetone, n-butanol, butanediol, isopropanol, butyric acid, methane, citric acid, fumaric acid, lactic acid, propionic acid, succinic acid, itaconic acid, acetic acid, acetaldehyde, 3-hydroxypropionic acid, glyconic acid and tartaric acid and amino acids such as L-glutaric acid, L-lysine, L-aspartic acid, L-tryptophan, L-arylglycines or salts of any of these acids.